

APRIL/MAY 2025

23PPH21 — STATISTICAL MECHANICS

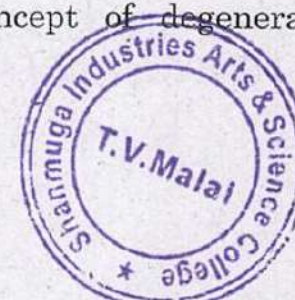
Time : Three hours

Maximum : 75 marks

SECTION A — ($10 \times 2 = 20$ marks)

Answer ALL questions.

1. List the concept of order parameters in phase transitions.
2. What is the third law of thermodynamics?
3. What is the microcanonical ensemble?
4. Define of phase space.
5. What is the canonical ensemble?
6. Outline the concept of energy fluctuations in ensembles.
7. What is Bose-Einstein condensation?
8. Infer the concept of degeneracy in quantum statistics.



9. What is the fluctuation-dissipation theorem?
10. Summarize the concept of mean-field theory in the Ising model.

SECTION B — ($5 \times 5 = 25$ marks)

Answer ALL questions.



11. (a) Write a short note on Gibb's Phase rule.

Or

- (b) Examine the role of thermodynamic potentials in phase equilibrium.

12. (a) Deduce the relation between statistical parameter and thermo dynamics.

Or

- (b) Inspect the significance of entropy of mixing in thermodynamics.

13. (a) How is the partition function used to calculate statistical quantities.

Or

- (b) Survey the role of the grand canonical ensemble in real-world systems.

14. (a) How does the Maxwell-Boltzmann distribution apply to classical gases?

Or

- (b) Categorize the implications of Fermi-Dirac statistics on an ideal Fermi gas.

15. (a) How is the Fokker-Planck equation used to describe transport phenomena?

Or

- (b) Classify the application of the Ising model in statistical mechanics.

SECTION C — ($3 \times 10 = 30$ marks)

Answer any THREE questions

16. Describe the Landau's theory of Phase transition.

17. Write a short note on Gibb's Paradox.

18. State and Prove Liouville's theorem.

19. Propose the differences between Maxwell-Boltzmann, Fermi-Dirac, and Bose-Einstein statistics.

20. Obtain the solution of Ising model in Isomerism.